Communities of *Berteroa incana* in Europe and their geographical differentiation*,**,***

L. Mucina[1] & D. Brandes[2]
[1] *Department of Geobotany, Institute of Experimental Biology and Ecology, Slovak Academy of Sciences, Sienkiewiczova 1, 814 34 Bratislava, Czechoslovakia*
[2] *University Library of the Technical University, Pockelsstrasse 13, D-3300 Braunschweig, F.R.G*

Keywords: *Berteroetum incanae, Dauco-Melilotion*, Europe, Geographical race, *Onopordetalia*, Synchorology, Syntaxonomy

Abstract

Two geographical races have been established within the *Berteroetum incanae* in Europe. The *Galium mollugo* race of the *Berteroetum incanae* is characteristic of the western part of the distribution area of the association whereas the relevés from the eastern part of Europe are classified as the *Acosta rhenana* race of the *Berteroetum incanae.* Adventitious *Berteroetum incanae* from the Netherlands has been shown to be a separate subunit within the *Galium mollugo* race of the *Berteroetum incanae.*

Introduction

Berteroa incana is a biennial rosette herb producing a high number of viable seeds. It is a competitive ruderal (sensu Grime, 1979). Phytosociologically it is limited to the order *Onopordetalia*, and especially the alliance *Dauco-Melilotion*. Communities in which *Berteroa* occurs as a dominant are found in many parts of Europe, though not very frequently. In this paper attention will be focussed on the geographical differentiation of these communities.

* A number of phytosociological relevés has been used by courtesy of Th. Müller, Nürtingen, F. Runge, Münster, V. Westhoff, Nijmegen, H. Lienenbecker, Steinhagen, H. Passarge, Eberswalde, W. Nezadal, Erlangen, W. Kunick, Stuttgart, F. Grüll, Brno, I. Jarolímek and M. Zaliberová, both Bratislava. For valuable comments on the manuscript we are indebted to V. Westhoff, E. van der Maarel, R. Neuhäusl and J. J. Barkman. The English of an earlier version of the manuscript has been kindly corrected by Mr Henry Moreton.
** The nomenclature of species follows Tutin *et al.* (1964–1980) with some changes according to Smejkal (1980).
*** *Acknowledgement*. The work of the senior author was partly supported by the University of Nijmegen Research Fellowship in Biology 1980/1981.

Material and methods

From Austria, Bulgaria, Czechoslovakia, Denmark, Federal Republic of Germany, German Democratic Republic, The Netherlands, Federal Republic of Germany, Poland and Roumania 211 relevés of *Berteroa incana* communities have been collected and combined into local rather homotoneous tables. With the aid of a computer these have been arranged into a synoptic table, in which species occur with their constancy class values. In columns representing local tables with less than 5 relevés the species are indicated by their real presence values. Condensed local tables (constancy values only) have been added to the synoptic table afterwards.

Syntaxonomical handling was accomplished by traditional methods of the Braun-Blanquet approach (Braun-Blanquet, 1964; see also Westhoff & van der Maarel, 1978). The columns in the table have been ordered from west to east in Europe. *Centaureo diffusae–Berteroetum* tables were added at the end of the synoptic table.

The numerical handling of the data includes numerical classification and ordination techniques. Ward's method (WM; Sum-of-squares clustering

Vegetatio 59, 125–136 (1985).

sensu Orlóci, 1967) and Complete linkage clustering (CLC; see Sneath & Sokal, 1973 for details) have been adopted as numerical classification methods. The original abundance and cover values of the Braun-Blanquet scale have been transformed according to ordinal transformation of van der Maarel (1979). The computation was performed with the CLUSTAN 1C package of Wishart (1978). Euclidean distance (ED) with WM and Similarity ratio (SR) with CLC (see Wishart, l.c. for further information) were used as resemblance functions. Reciprocal averaging (RA; Hill, 1973, program DECORANA, Hill, 1979) is the ordination technique used. Comparisons between classifications have been performed using Goodman-Kruskal coefficient of association (Goodman & Kruskal, 1954) and the program GOODM (Goldstein & Grigal, 1972).

Results

Syntaxonomy

On the basis of the Braun-Blanquet approach two associations were established within the ensemble of *Berteroa incana* communities (Table 1 see Appendix): *Berteroetum incanae* Sissingh et Tideman in Sissingh 50 and *Centaureo diffusae-Berteroetum* Oberdorfer 57.

Stands of the *Berteroetum incanae* are usually dominated by *Berteroa incana*, sometimes also by *Acosta rhenana* (in eastern Europe). They have two or three layers. Besides the dominating species also *Plantago lanceolata, Reseda lutea, Silene alba, Echium vulgare* and *Lolium perenne* form the upper herb sublayer. Some grasses reach as high as 1 m (*Agropyron repens, Arrhenatherum elatius*) and locally form another, third, rather loose sublayer. Some other tall herb species are found either in a vegetative stage (rosette) of the specimens of lower vitality. The lowermost sublayer is composed of dwarf or procumbent herbs as *Medicago lupulina, Alyssum alyssoides, Sedum sexangulare* and *Arenaria serpyllifolia*. In some place also a moss layer is found, usually including *Bryum argenteum, Brachythecium albicans, Hypnum vaucheri* and *Rhacomitrium canescens*.

The *Berteroetum incanae* colonizes well-drained, warm sandy to loamy (loess) soils of moderate nitrogen supply. The community occurs in very special habitats in the western part of its area, where it is restricted to docks and railway stations and more or less dependent on the steady supply of adventitious species. Originally, the community was described from tips near corn-mills in the south and southeast Netherlands. Recently it started spreading here along roads on sandy soils. On sandy soils it also occurs in Lower Saxony, the northern part of Franconia, Brandenburg and Mecklenburg. The habitats of the *Berteroetum incanae* in eastern Europe are more diverse. They are most frequently found on moderately alkalic soils along roads, on abandoned places of various origin, very often on loess slopes and river dykes or in limestone quarries (Mucina, 1981b).

Berteroa incana is considered the only character-species of the association *Berteroetum incanae*, with its optimum fidelity in western Europe. Though not dominant, *Berteroa incana* is quite common in other *Dauco-Melilotion* and *Onopordion* communities in eastern Europe (e.g. Gutte, 1972; Gutte & Hilbig, 1975; Kępczyński, 1975; Czaplewska, 1980; Mucina, 1981a, b).

According to the geographical variation the community can be divided into two subunits. The *Galium mollugo* race is characteristic of the northwestern part of the area (The Netherlands, Denmark, northern and western parts of F.R.G., a part of East Germany). *Holcus lanatus, Cerastium arvense, Carduus nutans, Lamium album, Senecio vulgaris* etc. are differentials for the unit.

The *Acosta rhenana* race, from Czechoslovakia, Poland, Hungary and the Balkans, is differentiated by a large number of species, particularly of (sub)-continental distribution (Table 1), many of which are shared with the *Centaureo-Berteroetum*.

Since all differential species except *Cichorium intybus* and *Crepis rhoeadifolia* have their sociological optimum in other syntaxa than in the *Dauco-Melilotion* alliance, the units discussed here are not considered as regional associations, but as geographical races (sensu Oberdorfer, 1957, 1968; Werger & van Gils, 1976; Westhoff & van der Maarel, 1978).

In western Europe the *Berteroetum incanae* occurs in contact with *Arrhenatheretalia* communities, whereas in eastern Europe it is more frequently found in contact with the *Festuco-Brometea* and *Sedo-Scleranthetea* (*Festucetalia valesiacae* and *Sedo-Scleranthetalia*).

As a rule the dominant species of the *Centaureo diffusae–Berteroetum* is *Acosta diffusa* (= *Centaurea diffusa*), *Berteroa incana* being a sub-dominant. The stands of the community are rather large in size (Oberdorfer, 1957), and rather open (50% average cover (Seybold & Müller, 1972).

The community occurs in particular along railways and at railway yards, on well-drained sandy soils with high amounts of ash and dross (Gutte & Hilbig, 1975; Sowa, 1975). As the sites are exposed to direct sun irradiation, the temperature of the substratum can become rather high. This favours not only the dominance of *Acosta diffusa*, but also the occurrence of other adventitious species as *Linaria genistifolia, Psyllium scabrum, Salsola kali* subsp. *ruthenica* as was observed in West and East Germany (Oberdorfer, 1957; Gutte & Hilbig, 1975). All these species are known to be thermophilous. The community as a whole seems to be adventitious throughout its distribution area.

Synecologically, the community is related to the group of communities dominated by *Salsola kali* ssp. *ruthenica, Psyllium scabrum* and *Corispermum species*. According to Oberdorfer (1957) there are syndynamical relations between the *Centaureo diffusae–Berteroetum* and the *Festuco–Sedetalia* and *Festuco–Brometea*. The *Centaureo diffusae–Berteroetum* is documented from West Germany, West Berlin, East Germany and Poland (see Appendix). *Acosta diffusa* is a regional character-species of the association. Differential species against the *Berteroetum incanae* include *Psyllium scabrum, Lepidium densiflorum, Oenothera parviflora* and *Herniaria glabra*. The segregation is strengthened by the absense of differential species against the *Berteroetum incanae* (*Silene alba, Dactylis glomerata, Urtica dioica* etc.). This group is largely composed of nitrophilous and mesophilous species, mostly of *Arrhenatheretalia* and *Sisymbrietalia*.

Cluster analyses

The first cluster dichotomy of WM (Fig. 1) splits the Dutch relevés of Sissingh (1950) and the rest of the material. Phytosociologically cluster H represents the *Berteroetum incanae* relevés on which the original description of the syntaxon has been based. The second dichotomy yields two clusters: D and B.

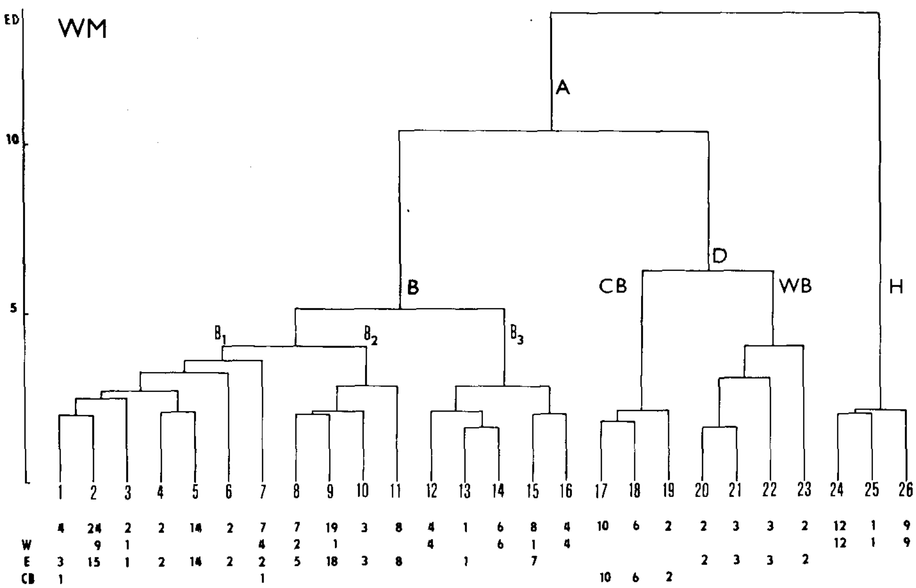

Fig. 1. Dendrogram of Ward's clustering method. Only the upper part of the hierarchy is shown (starting with 26 clusters). The numerals below the dendrogram indicate: total number of relevés, No. of the western race relevés, No. of the eastern race relevés, No. of the *Centaureo–Berteroetum* relevés in a starting cluster resp. B – the mixed cluster of the eastern and western race records; CB – the *Centaureo–Berteroetum* cluster; WB – the cluster of intermediate local tables (Berlin, Bavaria, etc.); H – the cluster of records from The Netherlands.

The former one is composed of two subclusters, viz. CB and WB. The cluster CB is entirely composed of the *Centaureo diffusae–Berteroetum* relevés. It comprises 90% of all *Centaureo–Berteroetum* relevés analyzed. The dendrogram branch 17 represents the *Centaureo-Berteroetum* from a part of Poland (the district of Lublin and the surroundings of Łodź), the others within the cluster CB are composed of relevés coming from Wrocław (Poland), West Berlin and southern F.R.G. The cluster WB comprises two local tables of the *Berteroetum incanae* s.str., namely those from West Berlin (the branches 20, 21; Fig. 1) and Bavaria (the branches 22, 23; Fig. 1). These correspond to the columns 14 and 11 of Table 1 resp. The tables come from the region where the two races of the *Berteroetum incanae* co-occur. Nevertheless, according to the overall floristic composition these local tables have been placed into the eastern race of the *Berteroetum incanae*.

The largest cluster B is a mixture of relevés of both *Berteroetum incanae* races. From the phytosociological point of view a somewhat clearer pattern arises on the level of the subclusters B_1, B_2 and B_3 within B. Cluster B_1, although composed mostly of the eastern race relevés, remains heterogeneous. Cluster B_2 is homogeneous. Cluster B_3 is also homogeneous.

The pattern in the WM dendrogram on the 4-cluster level, reasonably corresponds to that of the CLC (Fig. 1 and 2, Table 2).

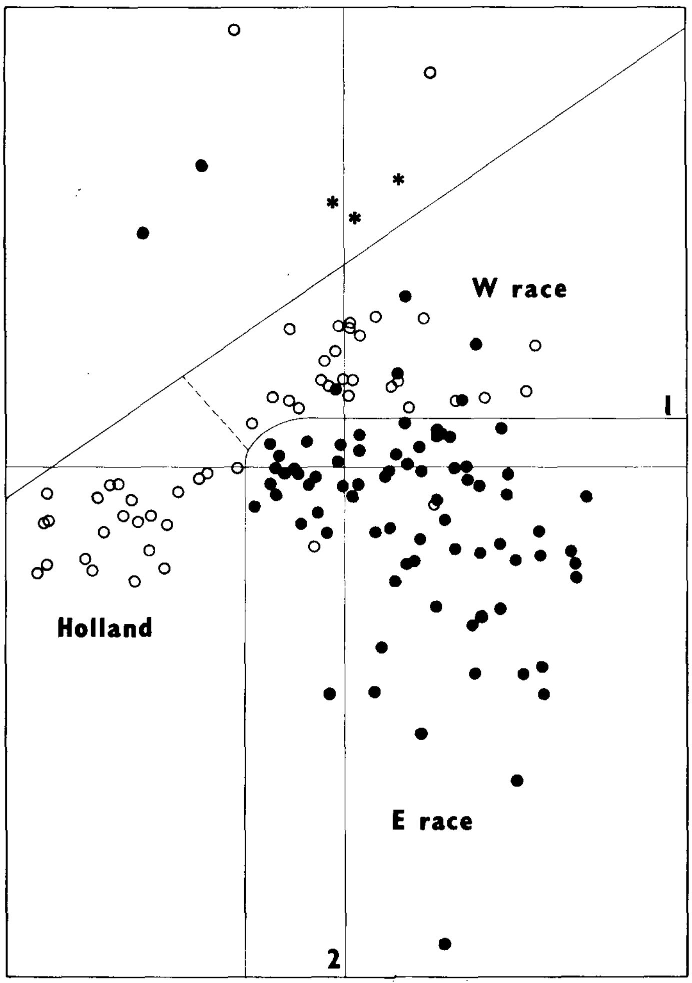

Fig. 2. Reciprocal averaging ordination plane (1st/2nd axes). Full circles – E race; empty circles – W race; asterisks – *Centaureo–Berteroetum*.

Table 2. Goodman-Kruskal comparisons of classifications of the *Berteroa incana* communities

	1	2	3
1 Syntaxonomical classification	x	0.395	0.400
2 Complete linkage clustering		x	0.727
3 Ward's method			x

Ordination

An ordination of the total data set produced a typical horseshoe on the ordination plane of axes 1 and 2. The bulk of relevés have been concentrated around the joining of the two wings of the horseshoe. The wings themselves include outlying *Centaureo–Berteroetum* respectively of *Acosta rhenana*-dominated relevés. After removing the outliers the subsequent ordination revealed a much clearer pattern. Some of the *Centaureo–Berteroetum* relevés are outliers being scattered along the positive side of axis 2. The geographical races of the *Berteroetum incanae* are separated along a diagonal (Fig. 3). The relevés from The Netherlands are separated from the *Acosta rhenana* race along axis 1. The remainder of the western material is more or less separated from the eastern one along axis 2. There is an overlap between the races along axis 2, which corresponds to the existence of mixed clusters, as depicted in Figures 1 and 2.

The data used for the numerical analyses are scattered throughout central Europe approximate-

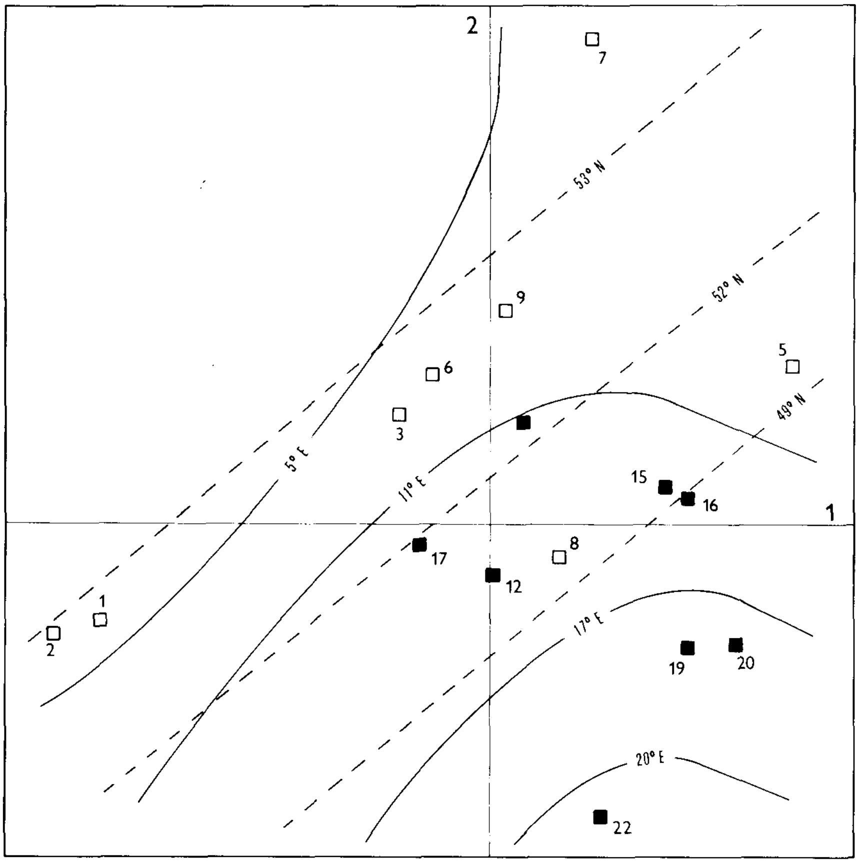

Fig. 3. Reciprocal averaging ordination of the *Berteroetum incanae* local tables. The centroids of the local tables are plotted. The solid and dashed lines represent geographical longitude and latitude resp. Full squares – E race; empty squares – W race; 1, 2 – the Netherlands; 3 – Westfalen; 5– Karlsruhe; 6 – Bielefeld; 7 – Bremen; 8 – Maindreieck near Ochsenfurt; 9 – Braunschweig; 10 – Hagenow, Schwanenbeck-Alpenberge, Berlin; 12 – Bamberg, Redniztal in Bavaria; 15 – Brno; 16 – Niederösterreich, Burgenland; 17 – Bydgoszcz; 19 – western Slovakia; 20 – Bratislava; 22 – the Východoslovenská Nížina Lowland.

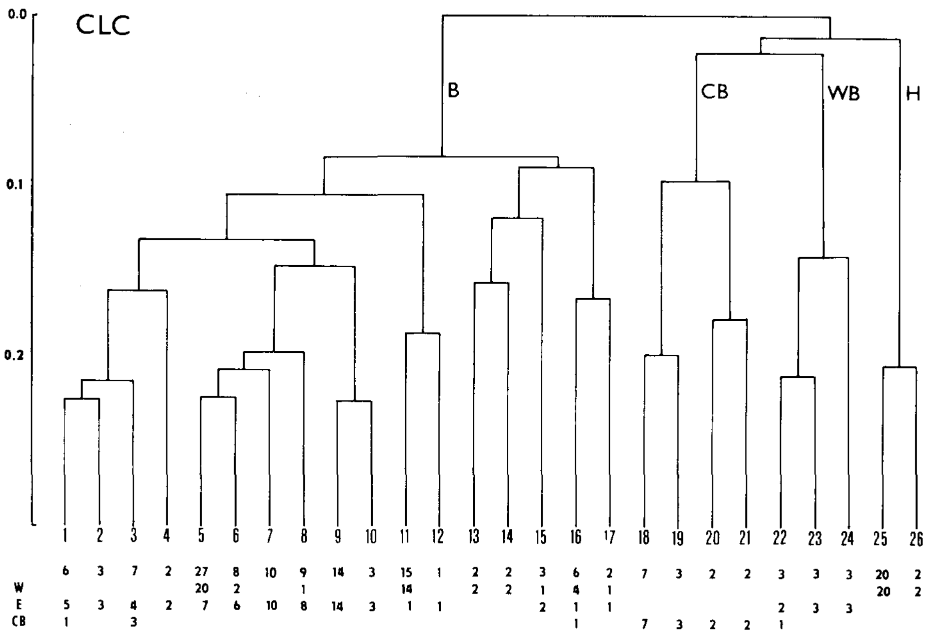

Fig. 4. Dendrogram of complete linkage clustering. For further explanation see Figure 1.

ly within the range 53 °N to 48 °N and 5 °E to 22 °E. It might seem that the area of the *Berteroetum incanae* in Europe is much larger in west–east direction than in the south–north one, but the community is also reported from Bulgaria (Table 1, column 24) and Sweden (Olsson, 1978).

The values for N latitude and E longitude for the local tables of the *Berteroetum incanae* s. str. show a diagonal isoline pattern (Fig. 4). The tables from Bavaria, Brandenburg, the surroundings of Braunschweig and Berlin (Table 1, columns 8-14) are considered 'transitional' as they are found where the races meet (Fig. 4). The distribution of the *Berteroetum incanae* in Europe is not continuous although the two races are not separated by a gap. There is a transitional zone between 10° to 13 °E and 49° to 52 °N where representatives of the races co-occur.

If we compare the RA-diagram with the WM dendrogram we find that the first WM dichotomy corresponds to the segregation of the clusters along axis 1, and the second one to the segregation along axis 2 (cf. Figs. 1 & 3).

Discussion

There are two general opinions concerning the width of the *Berteroetum incanae* as a syntaxon. A 'narrow' concept is promoted by Wešthoff & den Held (1975), Passarge (1964), Pop & Hodişan (1970) and to some extent also Soó (1973) and Mucina (1981b). In this conception the *Melandrio–Berteroetum* (a synonym of the *Berteroetum incanae*), *Verbasco–Berteroetum* Passarge 1957, *Centaureo diffusae–Berteroetum*, and some times also the *Rorippo pyrenaicae–Berteroetum* Pop et Hodişan form a group of vicarious associations (Passarge, 1964) or better: an association group (sensu Westhoff & van der Maarel, 1978). Seybold & Müller (1972) representing a 'broad' concept include not only the *Verbasco–Berteroetum* and *Centaureo–Berteroetum*, but also the *Verbasco–Chondrilletum* Tillich 1969 into the *Berteroetum incanae* s. l. Our current opinion is intermediate to the extent that we regard the *Centaureo–Berteroetum* as a separate association. This distinction is kept also by German and Czechoslovakian authors (Oberdorfer *et al.*, 1967; Oberdorfer & Müller, 1979; Hejný *et al.*, 1979). Most of the *Centaureo–Berteroetum* relevés come from Poland. This might be a reason why traditionally the relevés of the *Berteroetum incanae* s.str. are classified under the *Centaureo–Berteroetum* (Kępczyński, 1975; Czaplewska, 1980). The *Verbasco–Berteroetum* and *Rorippo–Berteroetum* could not be recognized in the synoptic table as separate associations, thus they were included into the list of synonyms of the *Berteroetum incanae* s.str. The *Melandrio–Berteroetum* and *Verbasco–Berteroetum* associations are included into the western race of the *Berteroetum incanae*, whereas the *Rorippo–Berteroetum* association is placed within the eastern race of the *Berteroetum incanae*. The *Cynoglosso–Berteroetum* (Olsson, 1978) from southern Sweden could not be included in the synthesis because a different sampling technique was used. Because of the lack of relevés from Hungary and the Balkan Peninsula we could not confirm the *Centaureo micranthae–Berteroetum* (Ubrizsy, 1955; see also Soó, 1971; Mititelu & Barabaş, 1972) as a regional association. Ubrizsy in Soó (1971) mentioned *Cephalaria transsilvanica* as a character-species of the latter unit. The one relevé from Bulgaria (Table 1, column 24) contains a number of submediterranean species. A reconsideration of the syntaxonomy of the *Berteroa incana*-dominated communities in Bulgaria may be appropriate if more material is available (see also Mucina, 1979).

Since the first descriptions (Westhoff *et al.*, 1946; Sissingh, 1950; Lebrun *et al.*, 1949; Oberdorfer, 1957), as early as 1966, (Ubrizsy, 1955; Passarge, 1964; Soó, 1964; Gutte, 1966) the *Berteroa incana* communities have been assigned to the *Onopordion acanthii*. Later, after Görs (1966) had described the *Dauco–Melilotion*, German and Czechoslovakian authors considered them as members of this newly described alliance (Seybold & Müller, 1972; Oberdorfer *et al.*, 1967; Oberdorfer & Müller, 1979; Hejný *et al.*, 1979; Gutte, 1972; Gutte & Hilbig, 1975; Mucina, 1981b). Only Westhoff & den Held (1975), and Polish, Roumanian and Hungarian authors still hold to the idea of the *Onopordion acanthii* as being the higher syntaxon of the *Berteroetum incanae* (cf. Pop & Hodişan, 1970; Fijałkowski, 1971; Mititelu & Barabaş, 1971, 1972; Rostański & Gutte, 1971, Kępczyński, 1975; Czaplewska, 1980). Until now the *Dauco–Melilotion* has not frequently been used in Poland, Hungary and Roumania. The description of a separate alliance *Berteroion incanae* by Radke (1979) is not supported by data.

The lower-ranked syntaxa described within the *Berteroetum incanae* s.str., namely the *Berteroetum incanae medicaginetosum* and *typicum* of Sissingh (1950), the *Berteroetum incanae*, typical variant, and the variant with *Salvia nemorosa* of Mucina (1981b) and the *Berteroetum incanae rorippetosum pyrenaicae* of Pop & Hodişan (1970), seem to be of very local importance. Like the race of *Salsola kali* of the *Centaureo–Berteroetum* (Gutte, 1972) they do not represent separate units in the synoptic tables.

Comparing both races of the *Berteroetum incanae* in terms of species diversity one recognizes a more general pattern, with a higher species diversity and higher number of plant associations per alliance towards southeastern Europe. This has also been noted within the *Malvion neglectae* and *Onopordion acanthii* (cf. Mucina, 1979, 1981a). This holds also for natural vegetation types, e.g. when comparing (sub)alpine chalk grasslands or beech woods of central Europe to those of the Balkan (see Neuhäusl in Dierschke, 1981). The causes of this phenomenon have not been appropriately evaluated yet. One could look for causes in dramatical florogenetical processes during Pleistocene glaciation which, gave origin to various floral refugia in eastern Europe, and to diversification centra of species. Diverse flora migration routes in the Holocene and a lower intensity of human impact upon the landscape in eastern Europe as well as a diversity of stands may also be considered.

A question may arise while inspecting the dendrograms why the first dichotomy does not correspond to the division into the *Berteroetum incanae* and *Centaureo–Berteroetum*. The *Centaureo–Berteroetum* appeared closer to the eastern race of the *Berteroetum incanae* and seemed to be rather a subunit of the eastern race than a separate association. Nevertheless, the *Centaureo–Berteroetum* is considered an association due to the high fidelity value of *Acosta diffusa*. The species, however, is weighted by SR the same way as any other discriminant character. Although there are many good discriminant characters (differential species) between the *Berteroetum incanae* and *Centaureo–Berteroetum*, the eastern race of the *Berteroetum incanae* and *Centaureo–Berteroetum*, have a lot of species in common, since the distribution areas of both phytocoena are largely the same.

The comparisons between the results of the numerical and syntaxonomical classifications, respectively (Table 2), yield rather low resemblance values. The differences might be explained by (1) differing classification criteria adopted in both approaches, the weighting of certain species (see the preceding paragraph), and (2) by the fact that the numerical classifications are based on relevés whereas the syntaxonomical treatment is based upon local tables.

References

Brandes, D., 1977. Die Onopordion-Gesellschaften der Umgebung Braunschweigs. Mitt. Florist.-Soziol. Arbeitsgem., N.F. 19/20: 103–113.

Braun-Blanquet, J., 1964. Pflanzensoziologie. Grundzüge der Vegetationskunde. 3. Aufl. Springer, Wien, New York. 865 pp.

Czaplewska, J., 1980. Zbiorowiska roślin ruderalnych na terenie Aleksandrowa Kujawskiego, Ciechocinka, Nieszawy i Wrocławka. Stud. Soc. Sci. Torunensis, Sect. Bot. 11: 1–76.

Dierschke, H., 1981. Zur syntaxonomischen Bewertung schwach gekennzeichneter Pflanzengesellschaften. In: H. Dierschke (ed.). Syntaxonomie, Ber. Int. Symp. Int. Ver. Vegetkde., pp. 109–122. J. Cramer, Vaduz.

Fijałkowski, D., 1971. Zbiorowiska synantropijne wyrobisk kręDowych w Chelmie i Rejowcu na Lubelszczyznie. Mater. Zakł. Fitosoc. Stosow. Uniw. Warszaw. 27: 273–289.

Fijałkowski, D., 1978. Synantropy roślinne Lubelszczyny. Lubel. Tow. Nauk., Prace Wydz. Biol. 5: 1–260.

Goldstein, R. & Grigal, D. F., 1972. Computer programs for the ordination and classification of ecosystems. Ecol. Sci. Div. Publ., Oak Ridge National Laboratory, 417 pp.

Goodman, L. A. & Kruskal, W. H., 1954. Measures of association for cross classifications. J. Am. Stat. Ass. 49: 732–764.

Grüll, F., 1982. Málo známá pionýrská společenstva rostlin na obnažených půdách stavenišť města Brna. Preslia 54: 149–166.

Gutte, P., 1966. Die Verbreitung einiger Ruderalpflanzengesellschaften in weiteren Umgebung von Leipzig. Wiss. Z. Univ. Halle, Ser. Math.-Nat. 15: 937–1010.

Gutte, P., 1972. Ruderalpflanzengesellschaften West- und Mittelsachsens. Feddes Repert. 83: 11–122.

Gutte, P. & Hilbig, W., 1975. Übersicht über die Pflanzengesellschaften des südlichen Teiles der DDR. XI. Ruderalgesellschaften. Hercynia N.F. 12: 1–30.

Hejný, S., Kopecký, K., Jehlík, V. & Krippelová, T., 1979. Přehled ruderálních rostlinných společenstev Československa. Rozpr. Čs. Akad. Věd., Ser. Math. Nat. 89/2: 1–100.

Hill, M. O., 1973. Reciprocal averaging: An eigenvector method of ordination. J. Ecol. 61: 237–249.

Hill, M. O., 1979. DECORANA. A Fortran program for detrended correspondence analysis and reciprocal averaging. Ecology and Systematics, Cornell University, Ithaca. iii + 52 pp.

Hülbusch, K. H. & Kuhbier, H., 1979. Zur Soziologie von Senecio inaequidens DC. Abh. Naturw. Verein Bremen 39: 47–54.

Kępczyński, K., 1975. Zbiorowiska roślin synantropijnych na terenie miasta Bydgoszczy. Acta Univ. Nicolae Copernici, Ser. Biol. 17: 3–87.

Lebrun, J., Noirfalise, A., Heinemann, P. & Vanden Berghen, C., 1949. Les associations végétales de Belgique. Bull. Soc. Roy. Bot. Belg. 82: 105–199.

Lienenbecker, H., 1968. Die Graukressen-Gesellschaft (Berteroetum incanae) im östlichen Westfalen. Natur u. Heimat 28: 126–127.

Maarel, E. van der, 1979. Transformation of cover-abundance values in phytosociology and its effects on community similarity. Vegetatio 39: 97–114.

Mititelu, D. & Barabaş, N., 1971. Vegetaţia Văii Trotuşului (sectorul Urecheşti – Tg. Trotuş). Stud. Comunic. Bacău: 791–820.

Mititelu, D. & Barabaş, N., 1972. Vegetaţia ruderală şi segetală din interiorul şi imprejurimile Municipiului Bacău. Stud. Comunic. Bacău: 127–148.

Mucina, L., 1979. Synantropná vegetácia stredného Považia I. – Spoločenstvá radu Onopordetalia. Thesis, Comenius University, Bratislava.

Mucina, L., 1981a. Die Ruderalvegetation des nördlichen Teils der Donau-Tiefebene. 1. Onopordion acanthii-Verband. Folia Geobot. Phytotax. 16: 225–263.

Mucina, L., 1981b. Die Ruderalvegetation des nördlichen Teils der Donau-Tiefebene. 2. Gesellschaften des Dauco–Melilotion-Verbandes auf ruderalen Standorten. Folia Geobot. Phytotax. 16: 347–389.

Oberdorfer, E., 1957. Süddeutsche Pflanzengesellschaften. Pflanzensoziologie 10: 1–564.

Oberdorfer, E., 1968. Assoziation, Gebietsassoziation, Geographische Rasse. In: R. Tüxen (ed.). Pflanzensoziologische Systematik. Ber. Int. Symp. Int. Ver. Vegetkde. Stolzenau/Weser 1964, pp. 124–141. Junk, Den Haag.

Oberdorfer, E. et al., 1967. Systematische Übersicht der westdeutschen Phanerogamen und Gefässkryptogamen-Gesellschaften. Schriftenrh. Vegetkde. 2: 7–62.

Oberdorfer, E. & Müller, Th., 1979. Pflanzensoziologische Exkursionsflora. 4. Aufl. Eugen Ulmer, Stuttgart. 997 pp.

Olsson, H., 1978. Vegetation of artificial habitats in northern Malmö and environs. Vegetatio 36: 65–82.

Orlóci, L., 1967. An agglomerative method for classification of plant communities. J. Ecol. 55: 193–205.

Passarge, H., 1959. Pflanzengesellschaften zwischen Trebel, Grenzbach und Peene (O-Mecklenburg). Feddes Repert. 138: 1–56.

Passarge, H., 1964. Über Pflanzengesellschaften des Hagenower Landes. Arch. Nat. Meckl. 10: 31–51.

Pop, I. & Hodişan, I., 1970. Studiu fitocenologic asupra unei asociaţii nitrofile nouă pentru România. Stud. Univ. Babeş-Bolyai, Ser. Biol. 1: 5–8.

Radke, G. J., 1980. System of ecologic and geographic landscape classification, shown in the central Europe region. Acta Bot. Acad. Sci. Hung. 26: 169–180.

Rostański, K. & Gutte, P., 1971. Roślinność ruderalna miasta Wrocławia. Mater. Zakł. Fitosoc. Stos. Uniw. Warszaw. 27: 167–215.

Seybold, S. & Müller, Th., 1972. Beitrag zur Kenntnis der Schwarznessel (Ballota nigra agg.) und ihre Vergesellschaftung. Veröff. Landesstelle Naturschutz Baden-Württemberg 40: 51–126.

Sissingh, G., 1950. Onkruid-associaties in Nederland. Thesis Wageningen. s'Gravenhage. 224 pp.

Smejkal, M., 1980. Komentovaný katalóg moravské flóry. Universita J. E. Purkyně, Brno. 301 pp.

Sneath, P. H. A. & Sokal, R. R., 1973. Numerical Taxonomy. W. H. Freeman & Co., San Francisco. 573 pp.

Soó, R., 1964. A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve. I. Akadémiai kiadó, Budapest. 589 pp.

Soó, R., 1971. Aufzählung der Assoziationen der ungarischen Vegetation nach den neueren zönosystematisch-nomenklatorischen Ergebnissen. Acta Bot. Acad. Sci. Hung. 17: 127–179.

Sowa, R., 1971. Flora i zbiorowiska ruderalne na obszarze województwa łódzkiego ze szczególnym uwzględnieniem miast i miasteczek. Universitet Łódzki, Lódź. 282 pp.

Tutin, T. G. et al. (eds.), 1964–1980. Flora Europaea. Vols. 1–5. University Press, Cambridge. 464, 455, 370, 505 & 452 pp.

Ubrizsy, G., 1955. Magyarország ruderalis gyomnövénytársulásai II. Ökológiai és szukcesszió-tanulmányok. Növénytermelés 4: 109–126.

Ullmann, I., 1977. Die Vegetation des südlichen Maindreiecks. Hoppea 36: 5–190.

Werger, M. J. A. & Gils, H. van, 1976. Phytosociological classification in chorological borderline areas. J. Biogeogr. 3: 49–54.

Westhoff, V., Dijk, J. W. & Passchier, H., 1946. Overzicht der Plantengemeenschappen in Nederland. 2nd ed. Uitg. K.N.N.V. & N.J.N., Amsterdam.

Westhoff, V. & Held, A. J. den, 1975. Planten-Gemeenschappen in Nederland. 2nd ed. W. J. Thieme & Cie, Zutphen. 324 pp.

Westhoff, V. & Maarel, E. van der, 1978. The Braun-Blanquet approach. In: R. Whittaker (ed.). Classification of Plant Communities, 2nd ed., pp. 287–399. Junk, The Hague.

Wishart, D., 1978. Clustan 1C. User Manual. St. Andrews Computing Centre, London. 175 pp.

Accepted 19.1.1984.

Appendix

Columns in the synoptic table

Table 1. Berteroetum incanae and *Centaureo diffusae–Berteroetum* in Europe.

Table 1. Berteroetum incanae in Europe

No. of column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
No. of relevés	15	[illegible]	3	1	4	9	2	3	11	11	5	7	6	5	4	7	15	8	21	20	4	10	2	1	4	2	10	4	5	5
Berteroa incana	.	V	3	1	4	.	2	3	.	.	V	V	V	IV	4	V	V	V	V	V	4	V	2	1	3	1	I	4	V	V
Westem race of Berteroetum incanae (D):																														
Holcus lanatus	I	.	1	.	.	.	1	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense	I	IV	1	.	.	.	.	1	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus nutans	.	.	.	.	.	II	2	.	I	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium album	.	III	.	.	.	I	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio vulgaris	I	II	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex arenaria	.	II	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium mollugo agg.	I	.	.	.	.	II	.	1	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Chamaeplium officinale	II	IV	2	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Verbascum thapsus	.	.	.	.	1	II	.	1	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Eastern race of Berteroetum incanae (D):																														
Kohlrauschia prolifera	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	I	2	.	.	.	.	.	.	.	.	.
Vicia angustifolia	.	.	.	.	.	.	.	.	I	.	.	.	II	.	.	I	.	.	.	I	.	I	2	.	.	.	.	.	.	.
Chondrilla juncea	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	I	I	.	I	.	.	.	.	.	.	.	.
Crepis biennis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	I	.	II	.	.	I	.	.	.	.	.	.	.	.
Coronilla varia	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	II	I	I	I	.	.	.	1	.	.	.	.	.	.
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	I	.	I	1	.	.	.	.	1	.	.
Leontodon hispidus	.	.	.	.	.	.	.	.	I	.	.	.	.	.	3	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.
Crepis rhoeadifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.
Crepis capillaris	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.
Papaver dubium	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.
Achillea pannonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I	.	.	.	.	.	.	.	.
Lepidium campestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	1	.	.	.	.	.	.	.
Sisymbrium orientale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	3	I	.	1	.	.	.	.	.	.
Cynodon dactylon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	1	.	.	1	.	.	.	.	.	.
Eastern race + Cent.-Bert. (D):																														
Acosta rhenana	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	I	.	III	II	2	II	.	.	.	1	I	.	IV	.
Carduus acanthoides	.	.	.	.	.	.	.	.	I	.	.	I	I	.	3	III	I	III	IV	III	.	III	.	.	2	.	IV	4	.	.
Cichorium intybus	.	.	.	.	3	.	.	.	.	.	II	II	.	I	.	I	.	II	I	III	.	III	.	.	3	1	II	1	.	.
Silene vulgaris	.	.	.	.	.	.	.	2	.	.	II	.	.	.	.	.	I	.	I	I	.	.	.	.	.	.	.	.	II	.
Lactuca serriola	.	.	.	.	.	.	2	.	.	.	I	.	.	I	3	II	.	.	III	I	1	I	.	.	2	.	II	.	.	.
Saponaria officinalis	.	.	.	.	.	.	.	2	.	.	I	II	I	II	.	.	I	.	I	.	.	.	.	1	2	.	II	1	.	.
Solidago canadensis	.	.	1	.	.	.	.	.	.	.	.	.	II	II	.	.	.	.	.	.	.	.	.	.	.	2	III	1	.	.
Tussilago farfara	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I	.	.	.	I	.	.	1	.	.	.	.	.	.	I
Lepidium ruderale	.	I	.	.	.	.	.	.	.	.	.	.	.	.	4	.	I	.	.	I	.	.	.	.	.	.	.	.	.	I
Calamagrostis epigeios	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	I	.	.	.	.	.	1	V	.	.	.
Diplotaxis muralis	.	.	.	.	.	.	1	.	.	.	.	.	.	III	.	.	.	.	I	I	.	.	.	.	.	.	III	.	I	.
Lotus corniculatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	I	I	.	.	.	.	.	1	.	.	.	.
Jacea vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I	.	.	.	.	I	.	.	.
Erigeron acris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	1	II	.	.	.
Pimpinella saxifraga	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	II	I	.	I	.	.	.	.	.	.	.	I
Festuca rupicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	1	I	.	.	.	.	.	.	III	.
Salsola ruthenica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	1	I	.	.	.	.	V	.	.	.
Onopordum acanthium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	.	I
Oenothera rubricaulis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	III	1	.	.
Amaranthus retroflexus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	1	I	.	.	.	.	I	.	.	.
Centaureo-Berteroetum (Ch):																														
Acosta diffusa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	2	V	3	V	V

Centaureo-Berteroetum (D):

Psyllium scabrum	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	III	.	.	.
Lepidium densiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	1	I	II
Ceratodon purpureus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	1	.	.	.	.	.	2	I	III
Oenothera parviflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	V	.	.	.
Herniaria glabra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	I	I

Berteroetum incanae (D):

Silene alba	V	III	1	.	.	IV	.	3	IV	V	I	III	III	.	.	.	III	.	I	III	1	III	2	.	.	.	.	.	.	I
Dactylis glomerata	I	II	1	.	2	IV	2	2	V	III	II	IV	.	.	.	III	II	III	II	I	3	I	.	1	2	.	.	.	.	.
Urtica dioica	I	I	.	.	.	III	.	.	.	III	.	.	.	I	.	.	I	III	I	.	.	I	1	.	.	.	.	.	.	.
Arrhenatherum elatius	I	III	.	.	.	IV	.	1	II	.	I	II	.	I	.	II	.	.	II	I	1	.	.	.	.	.	I	.	.	.
Acetosa vulgaris	I	I	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	I	.	.	.	II	.	.	.	.	.	.	.	.
Knautia arvensis	I	.	.	.	.	.	.	.	I	I	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	I
Descurainia sophia	I	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	I	.	.	.	.	.	.	.	.
Cardaria draba	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	I	.	.	.	.	.	.	.	.	.	.
Galium verum	I	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.
Geranium pusillum	III	V	.	.	.	.	.	1	.	I	.	.	.	.	.	.	.	.	I	.	.	I	2	.	.	.	.	.	.	.
Atriplex patula	II	II	.	.	.	II	.	.	.	.	II	.	.	.	.	.	.	.	I	I	.	II	.	.	.	.	.	.	.	.
Poa annua	III	I	.	.	.	I	.	.	.	.	.	.	.	I	.	.	III	III	.	.	.	.	.	.	.	.	.	.	.	I
Equisetum arvense	I	II	2	1	.	I	.	.	I	II	.	II	I	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	I
Cyanus segetum	I	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.
Raphanus raphanistrum	I	I	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
Sonchus arvensis	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	I	.	I	.	.	1	.	.	.	.	.	.	.
Stellaria media	IV	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
Medicago sativa	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	1	I	.	.	.	.	.	.	.	.
Hypericum perforatum	I	III	.	1	.	III	.	.	II	I	.	II	III	I	.	I	.	.	I	I	.	.	.	1	.	.	.	1	.	.
Tithymalus cyparissias	I	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	II	II	I	1	I	1	.	.	.	.	.	.	.
Acetosella vulgaris	III	III	.	.	.	II	.	.	I	I	III	III	III	.	.	.	.	I	.	.	1	I	2	.	.	.	.	.	.	.
Trifolium arvense	I	.	.	.	.	II	.	.	II	.	IV	V	V	.	.	.	I	I	.	I	3	I	.	1	.	.	.	.	.	.
Chrysaspis campestre	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	1	.	.	.	.	.	.

Dauco-Melilotion:

Anchusa officinalis	I	.	.	1	.	.	.	3	.	I	.	II	.	.	.	.	III	.	I	I	1	I	.	.	.	.	.	1	.	.
Daucus carota	.	.	1	.	4	III	.	.	II	.	III	II	IV	IV	3	IV	.	II	III	III	.	I	.	.	2	1	V	2	.	.
Echium vulgare	I	I	.	.	4	I	.	1	I	II	II	III	I	.	.	IV	III	II	III	III	1	I	2	.	4	.	V	2	II	II
Linaria vulgaris	II	I	.	.	4	II	.	2	I	.	I	.	.	III	3	I	.	.	I	II	.	.	2	.	3	.	I	.	.	I
Melilotus officinalis	III	IV	.	.	.	II	.	.	IV	.	.	I	.	II	4	IV	I	.	I	III	.	.	.	.	1	.	II	.	.	.
Melilotus alba	.	.	.	.	2	III	.	.	I	.	I	II	I	I	2	.	I	II	I	.	.	II	1	.	.	.	III	1	I	I
Oenothera biennis	I	.	.	.	3	IV	.	.	V	.	III	V	V	III	.	I	.	III	.	.	.	.	.	.	3	2	III	4	I	.
Reseda lutea	I	II	.	.	4	III	.	1	II	.	.	.	.	I	.	III	.	.	III	II	.	.	.	.	4	.	IV	1	.	.
Potentilla intermedia	I	II	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	I	1	.	.
Picris hieracioides	.	.	.	.	4	.	.	.	.	.	.	.	.	.	3	.	.	.	II	I	.	.	.	.	3	.	.	.	.	.
Acetosa thyrsiflora	.	.	.	1	2	.	.	3	.	.	III	V	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Tragopogon dubius	.	.	.	.	2	.	.	.	.	.	.	.	.	I	.	.	.	.	I	I	.	.	.	.	2	.	.	.	.	.
Verbascum densiflorum	I	.	.	.	.	.	1	.	.	.	.	II	.	.	.	.	.	.	I	.	.	.	.	.	.	.	III	.	.	.
Medicago varia	I	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	1	.	.	.	.
Verbascum phlomoides	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	1	.	.

Crepis polymorpha 1 (5,25); Crepis tectorum I (17), III (28); Erigeron annuus I (20), 1 (26); Isatis tinctoria 2 (5), 1 (25); Oenothera depressa I (22), II (30); Odontites vulgaris II (22); Verbascum nigrum I (6,10); Crepis setosa I (20); Oenothera chicagoensis I (13); Oenothera hoelscheri 1 (27);

Onopordion acanthii:

Artemisia absinthium	I	I	.	.	2	.	.	.	.	.	.	.	.	I	.	.	II	III	I	I	.	II	.	1	2	.	.	1	III	II
Reseda luteola	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.

Hyoscyamus niger I (2,19); Lappula squarrosa I (19),2 (23); Verbascum blattaria I (19),1 (25); Lavatera thuringiaca I (22); Marrubium peregrinum I (16), 2 (21); Marrubium vulgare I (10); Nepeta cataria I (2); Stachys germanica 1 (23); Xeranthemum annuum 1 (21); Cota austriaca 4 (21);

Artemisietea vulgaris:

Artemisia vulgaris	I	I	2	1	4	V	1	1	V	V	V	V	V	III	4	III	V	V	II	IV	2	II	.	1	4	2	IV	3	.	I
Medicago lupulina	I	I	1	1	3	.	.	.	IV	.	IV	I	III	II	4	.	II	I	II	II	.	II	.	.	2	2	II	2	.	III
Ballota nigra	I	II	.	.	.	.	.	1	.	.	II	.	.	.	.	.	II	III	I	I	.	II	.	1	.	.	I	2	.	.
Tanacetum vulgare	I	I	.	.	.	IV	1	.	V	IV	IV	V	III	.	.	.	III	.	.	I	.	.	.	.	.	.	II	2	.	.
Cirsium vulgare	.	.	.	.	1	II	.	.	.	.	I	I	.	.	.	.	.	.	.	I	.	.	.	.	1	.	III	.	.	.
Arctium minus	I	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.
Solidago gigantea	.	.	.	.	.	II	.	.	I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex obtusifolius	I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus caesius	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.

Carduus crispus II (9), I (19); Lapsana communis I (19), 1 (20); Anthriscus sylvestris I (19); Arctium lappa I (17); Armoracia rusticana I (13); Calystegia sepium I (19); Chaerophyllum temulum I (10); Chelidonium majus I (16); Conium maculatum I (1); Dipsacus laciniatus I (19); Echinops shaerocephalus I (19); Geranium pyrenaicum I (20); Helianthus tuberosus 1 (24), II(11); Leonurus cardiaca I (30) ; Torilis japonica 1 (4); Silene dioica 1 (3); Solanum dulcamara I (14); Malva sylvestris 2 (7), 1 (24);

Chenopodietea:

Conyza canadensis	I	III	1	.	4	V	1	1	III	I	V	V	IV	II	4	III	IV	IV	II	I	3	I	2	.	3	2	IV	1	III	.
Sisymbrium loeselii	III	II	.	.	2	.	.	.	.	.	.	.	I	II	.	.	I	.	II	I	.	.	.	.	1	1	.	2	.	.
Anisantha sterilis	I	.	1	.	.	.	.	.	II	.	I	.	.	.	.	II	.	.	II	I	.	.	.	.	.	.	I	.	.	.
Sisymbrium altissimum	I	I	.	.	.	II	2	.	III	.	I	II	.	.	.	.	.	.	I	I	.	.	.	.	.	.	V	1	I	.
Sonchus oleraceus	I	I	.	.	.	.	1	.	.	.	.	.	.	.	3	.	.	.	I	.	.	.	.	.	.	.	I	.	.	.
Sinapis arvensis	I	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	I	.	.	.	1	.	.	.	.	.	.	I
Hordeum murinum	II	.	.	.	3	.	1	.	.	.	.	.	.	I	.	I	.	.	I	II	.	.	.	.	2	.	.	1	.	.
Setaria viridis	.	.	.	.	3	.	1	.	.	.	I	.	.	.	.	.	.	.	I	.	3	I	.	.	1	.	.	.	I	.
Malva neglecta	I	II	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	II	.	.	.	I	.	.	.	.	.	.	.	I
Diplotaxis tenuifolia	.	.	.	.	3	II	1	1	I	.	.	.	.	.	.	II	.	.	.	I	.	.	.	.	3	.	V	1	.	.
Echinochloa crus-galli	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	.	.	.
Digitaria sanguinalis	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	4	I	.	.	.	.	.	.	.	.
Atriplex tatarica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	1	I	.	.	.	.	.	.	.	.

Amaranthus albus I (22,28); Ambrosia artemisiifolia I (1,2); Atriplex acuminata 1 (8,25); Bunias orientalis I (7), 5 (23); Erucastrum gallicum 3 (4), 1 (25); Erysimum cheiranthoides I (6), II (17); Tithymalus helioscopius I (12,19); Tithymalus peplus I (12,19); Galeopsis tetrahit II (6), I (18); Geranium columbinum 1 (8), I (16); Lepidium virginicum I (1), III (12) Matricaria recutita I (1,30); Persicaria maculata I (1,17); Solanum nigrum II (1), III (28); Urtica urens I (1,2); Xanthium strumarium I (17,30); Aethusa cynapium I (1); Amaranthus powellii (2); Atriplex oblongifolia 1 (26); Chenopodium strictum I (22); Diplotaxis viminea I (12); Eragrostis minor I (22), 1 (21); Fumaria vaillantii I (19); Galinsoga urticifolium I (12); Iva xanthiifolia I (28); Setaria glauca III (22); *Portulaca oleracea* 1 (21);

Secalietea:

Apera spica-venti	II	I	.	.	.	.	.	.	III	.	.	IV	V	II	.	.	.	IV	.	I	.	.	.	.	.	.	I	2	.	.
Anthemis arvensis	I	I	.	1	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	2	.	.	.	.	.	.	II
Papaver rhoeas	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	I	1	.	.	.	.	.	.	.	.	.
Viola arvensis	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	I	.	1	.	.	.	.	.	.	.	.	.

Allium vineale I (1,2); Avena fatua 1 (7), I (19); Nigella arvensis ; (19,22); Papaver argemone 1 (7), (12); Vicia villosa I (13,20); Chamaepitys trifida I (19); Anagallis arvensis I (12); Aphanes arvensis I (12); Camelina microcarpa I (19); Camelina sativa I (28); Consolida regalis I (19); Kickxia elatine I (28); Kickxia spuria I (19); Lathyrus tuberosus I (19); Linaria arvensis I (19); Neslia paniculata 2 (23) Nonnea pulla I (19); Silene noctiflora I (28); Stachys annua I (19);

Agropyretea repentis:

Poa compressa	.	.	.	.	2	.	2	1	I	.	.	.	I	III	.	.	.	.	I	I	.	.	2	.	1	1	III	3	II	II
Carex hirta	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	1	.	.	II	.
Tithymalus esula	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	I	I	.	I	.	.	.	.	.	.	.	.	.	.	.
Falcaria vulgaris	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I	.	II	.	.	.	.	.	.	.	.	.
Cota tinctoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.

Plantaginetea majoris:

Polygonum aviculare agg.	IV	IV	.	.	.	.	1	1	.	.	III	.	.	I	4	.	III	V	I	.	.	III	.	.	.	.	.	.	II	IV
Plantago major	III	II	I	1	.	I	.	.	.	.	.	I	.	.	2	.	.	II	I	I	.	I	.	.	.	.	II	2	.	I
Rumex crispus	I	.	.	.	.	.	1	.	I	.	.	.	I	.	.	.	.	.	I	I	.	.	1	.	.	.	.	.	.	.
Scorzoneroides autumnalis	III	I	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	I
Agrostis stolonifera	I	.	.	1	.	.	.	.	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Potentilla reptans	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	I	.	.	.
Polygonum arenastrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	4	I	.	.	.	.	.	.	.	.

Glechoma hederacea I (1,22); Inula britannica I (28); Matricaria suaveolens I (17); Mentha longifolia 1 (23); Podospermum laciniatum I (19); Centaurium pulchellum 1 (21?; Argentira anserina II (30); Potentilla supina I (19); Prunella vulgaris III (30); Ranunculus repens I (1), 1 (4); Rumex triangulivalvis I (2);

Convolvulo-Chenopodiea:

Elytrigia repens	V	V	.	1	.	III	2	3	II	II	V	.	IV	.	.	I	III	III	IV	II	1	III	.	.	.	1	II	2	.	II
Convolvulus arvensis	IV	III	.	1	4	III	.	2	I	III	V	II	III	.	.	I	III	II	IV	II	.	I	.	.	3	.	I	.	.	.
Chenopodium album	V	V	.	.	.	.	2	.	I	.	II	.	.	I	.	I	II	III	.	I	1	II	.	.	.	.	I	.	III	.
Capsella bursa-pastoris	III	III	1	.	.	.	1	1	I	.	III	.	.	.	.	.	III	IV	I	I	.	I	2	.	.	.	.	.	.	III
Matricaria perforata	.	.	1	.	2	II	1	2	II	.	II	IV	I	.	4	.	.	.	II	III	.	I	.	.	3	.	III	.	.	.
Cirsium arvense	.	.	.	1	2	.	.	.	I	.	I	.	I	III	2	.	IV	.	I	I	.	.	.	.	2	1	III	.	.	.
Fallopia convolvulus	II	III	.	.	.	.	.	.	.	.	I	.	.	.	3	.	.	I	I	I	.	I	.	.	.	.	II	.	.	.

Molinio-Arrhenatheretea:

Achillea millefolium	V	V	1	1	3	V	.	1	IV	V	IV	III	III	IV	4	I	V	IV	IV	IV	.	IV	2	.	2	2	II	3	II	V
Plantago lanceolata	III	III	2	1	2	V	.	2	II	II	IV	V	III	.	.	IV	II	III	III	IV	3	V	2	.	1	1	III	1	.	I
Trifolium repens	I	I	1	.	.	III	1	.	I	.	I	I	.	.	.	I	I	.	I	II	.	II	1	.	.	1	I	.	I	I
Taraxacum sect. Vulgaria	II	II	2	1	.	.	.	.	II	.	IV	I	I	II	3	II	V	II	II	I	.	III	.	.	.	.	III	2	IV	.
Lolium perenne	IV	III	2	.	.	II	1	.	II	.	III	IV	IV	I	2	II	I	II	II	III	3	II	.	.	.	.	I	3	I	I
Poa pratensis	III	V	.	.	.	III	.	.	IV	V	II	III	.	IV	4	.	IV	IV	I	I	.	.	2	.	.	.	.	2	I	II
Pastinaca sativa	.	.	.	.	2	I	.	2	I	.	.	.	.	.	.	I	.	.	II	.	.	I	.	.	2	.	I	.	.	.
Agrostis tenuis	IV	V	.	.	.	III	.	.	I	I	II	.	IV	.	.	.	.	.	.	.	.	I	.	.	.	.	III	.	I	III
Festuca rubra	II	III	1	.	.	.	.	1	I	.	.	I	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	1	.	I
Hypochoeris radicata	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.

Anthoxanthum odoratum I (1), II (6); Campanula rotundifolia I (1), II (2); Cerastium holosteoides 1 (23) , II (28); Festuca pratensis I (6), 1 (27); Galium album I (16,19); Poa palustris I (19,22); Tragopogon pratensis I (9); Agrostis gigantea 1 (26); Bellis perennis I (30); Geranium molle I (1); Lathyrus pratensis 1 (23); Leucanthemum vulgare agg. 1 (23); Phleum pratense I (19); Pimpinella major I (16); Poa trivialis I (1); Rorippa pyrenaica 2 (23); Thymus serpyllum I (22); Veronica chamaedrys I (30); Vicia sepium I (22); Vicia cracca I(16,20);

Festuco-Brometea:

Eryngium campestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	1	I	.	.	.	.	.	.	.	.
Artemisia campestris	.	.	.	.	2	.	1	.	I	I	II	.	III	IV	.	.	I	II	II	I	.	I	.	1	3	.	.	.	V	.
Poa angustifolia	.	.	.	.	4	.	.	1	I	.	.	.	I	II	.	II	.	.	I	I	.	II	.	.	4	1	.	.	.	.
Medicago falcata	I	V	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	I	I	.	II	.	.	.	1	.	.	.	I
Pilosella sp. div.	I	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	II
Festuca ovina	.	.	.	.	.	I	.	.	I	I	II	II	II	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.
Salvia verticillata	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	2	.	2	.	.	.	.	.
Salvia nemorosa	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	I	.	.	.	.	.	.	.	.
Erysimum diffusum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	1	I	.	.	.	.	.	.	.	.

Tithymalus waldsteinii I (20,28); Hieracium umbellatum I (6,28); Linaria genistifolia I (20); Potentilla arenaria I (28,29); Scabiosa ochroleuca I (19), 1 (27); Taraxacum sect. Erythrosperma I (1,2); Verbascum lychnitis 1 (5,25); Achillea collina I (19), 2 (21); Asparagus officinalis I (9); Asperula cynanchica I (19); Carex humilis I (19); Colymbada scabiosa I (16); Tithymalus seguierianus I (19); Festuca pseudovina I (22); Festuca tenuifolia I (1); Festuca trachyphylla I (19); Leontodon incanus I (19); Linum austriacum I (19); Onobrychis arenaria I (19); Ononis repens I (8); Plantago media 1 (23); Ranunculus bulbosus I (2); Sanguisorba minor I (19); Senecio jacobea I (10); Silene otites I (22); Tragopogon orientalis I (16); Verbascum austriacum I (16); Pseudolysimachion spicatum I (18); Viola saxatilis 2 (23); Medicago minima 1 (21); Leopoldia comosa 1 (21); Artemisia austriaca 1 (21);

Sedo-Scleranthetea:

Erodium cicutarium	I	I	.	.	.	.	.	1	.	.	III	I	.	.	.	.	.	I	I	I	3	.	.	.	.	.	I	1	.	I
Sedum acre	I	II	.	.	1	.	1	.	I	.	I	.	.	II	.	.	I	.	.	I	.	.	.	.	3	.	.	.	I	.
Bromus mollis	IV	III	.	.	.	IV	1	.	I	I	III	IV	IV	I	.	.	IV	.	I	I	3	I	.	.	.	1	I	.	I	II
Anisantha tectorum	I	.	.	.	1	.	1	.	.	.	II	IV	.	II	.	I	III	.	II	II	1	.	2	1	4	1	II	2	IV	.
Arenaria serpyllifolia	.	.	1	.	.	I	1	1	I	.	II	.	.	.	.	.	I	.	II	.	2	.	2	1	.	.	.	.	II	.
Potentilla argentea	I	IV	.	.	.	.	.	.	.	I	II	III	.	I	.	.	I	.	I	II	3	II	.	.	.	.	.	2	I	.
Senecio viscosus	.	.	.	.	3	.	1	.	I	.	II	.	.	I	.	.	.	.	.	.	.	.	.	.	3	.	.	.	I	.
Vicia hirsuta	.	I	.	1	.	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthemis ruthenica	I	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Bromus squarrosus	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	2	.	.	.	2	.	.	.	.	.
Scleranthus annuus	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.

Acinos arvensis I (19, 29); Alyssum alyssoides I (19,29); Arabidopsis thaliana I (12), 1 (26); Cardaminopsis arenosa I (14), 2 (23); Helichrysum arenarium I (13,17); Scleranthus annuus I (12), 1 (23); Armeria elongata I (12); Cerastium semidecandrum I (1); Corynephorus canescens I (17); Draba nemoralis 1 (23); Poa bulbosa 2 (21); Phleum bertoloni I (2); Hylotelephium maximum I (3); Sedum sexangulare I (12); Valerianella dentata 2 (23); Veronica arvensis 2 (23), 1 (21); Vulpia bromoides I (28); Vulpia myuros 1 (24), 2 (21);

Other species (Trifolio-Geranietea, Thlaspietea rotundifolii, Rhamno-Prunetea, Querco-Fagetea and others):

Epilobium angustifolium 1 (7), I (9); Linaria repens I (5), 1 (25); Rosa canina I (14, 19); Sambucus nigra I (1,14); Agrimonia eupatoria I (21); Ailanthus altissima juv. I (20); Arctium sp. 1 (27); Aster sp. I (28); Avena sativa I (19); Bromus sp. I (19); Clematis vitalba I (20); Clinopodium vulgare I (16); Crepis sp. I (19); Fragaria viridis I (19); Helianthus annuus I (28); Helianthus sp. I (13); Hieracium caespitosum I (28); Holcus mollis I (1); Inula conyza I (16); Juglans regia I (19); Lathyrus sylvestris I (7); Mentha sp. I (28); Oenothera ammophila I (28); Origanum vulgare I (20); Oxybaphus nictaginea I (2); Reseda gracilis 1 (5); Robinia pseudacacia I (20); Rubus fruticosus agg. I (20); Panicum miliaceum 1 (7); Pinus sylvestris I (9); Potentilla erecta II (30); Prunus avium I (19); Prunus sp. I (23); Syringa vulgaris I (16); Taraxacum obliquum I (28); Trifolium medium I (15); Veronica sp. I (20); Vicia tenuifolia I (20); Achillea coarctata 1 (24); Anchusa barreleri 1 (24); Silene longiflora 1 (24); Abietinella abietina I (19); Tortula muralis

Bryophyta:

Musci indet.	.	.	1	.	.	III	.	.	III	.	.	V	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Bryum argenteum	III	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	2	.	.	.	.	.	.	1	.	II

Brachythecium albicans I (2), 2 (27); Brachythecium sp. I (1,22); Pohlia sp. II (1), III (2); Aloina rigida III (30); Barbula convoluta I (30); Bryum caespiticium 2 (27); Campylium chrysophyllum I (30); Hypnum vaucheri I (19); Rhacomitrium canescens I (1); III (30); Bryum badium I (20);

Berteroetum incanae, Galium mollugo race:

1. Sissingh (1950), The Netherlands, 15
2. Sissingh (1950), The Netherlands, 7
3. Runge (unpubl.), Westfalen (F.R.G.), 3
4. Westhoff (unpubl.), Molsbergen (Denmark), 1
5. Th. Müller (unpubl.), Ulm, Soflingen, Krs. Ludwigsburg (F.R.G.), 4

6. Lienenbecker (1968, unpubl.), vicinity of Bielefeld (F.R.G.), 9
7. Hülbusch & Kuhbier (1979), Bremen (F.R.G.), 2
8. Ullmann (1977), Maindreieck near Ochsenfurt (F.R.G.), 3
9. Brandes (1977, unpubl.), vicinity of Braunschweig (F.R.G.), 11
10. Passarge (1959), Brandenburg, Ost-Mecklenburg (G.D.R.), 11

Berteroetum incanae, Acosta rhenana race:
11. Nezadal (unpubl.), Rednitztal near Nürnberg (F.R.G.), 5
12. Brandes (unpubl.), Bamberg (F.R.G.), 6
13. Passarge (1964, unpubl.), Hagenow, Schwanenbeck-Alpenberge, Berling (G.D.R.), 7
14. Kunick (unpubl.), West Berlin (F.R.G.), 5
15. Grüll (1982), Brno (Czechoslovakia), 4
16. Forstner (unpubl.), Niederösterreich, Burgenland (Austria), 7
17. Kępczyński (1975), Bydgoszcz (Poland), 15
18. Czaplewska (1980), Aleksandrowie Kuj., Ciechocinek, Nieszawa, Wroclawek (Poland), 8
19. Mucina (1981b, unpubl.), the western part of Slovakia (Czechoslovakia), 21
20. Jarolímek (unpubl.), Bratislava (Czechoslovakia), 20
21. Mucina (unpubl.), the southern part of the Podunajská Nížina Lowland (Czechoslovakia), 4
22. Mucina & Zaliberová (unpubl.), the Východoslovenská Nížina Lowland (Czechoslovakia), 10
23. Pop & Hodişan 1970, Valea Someşului Rece (Roumania), 2
24. Mucina (unpubl.), Melnik (Bulgaria), 1

Centaureo diffusae-Berteroetum:
25. Oberdorfer (1957), Karlsruhe, Mannheim (F.R.G.), 2
26. Th. Müller (unpubl.), Krs. Ludwigsburg (F.R.G.), 2
27. Kunick (unpubl.), West Berlin (F.R.G.), 2
28. Gutte (1966), vicinity of Leipzig (G.D.R.), 10
29. Rostański & Gutte (1971), Wrocław (Poland), 4
30. Sowa (1971), Łódz, Tomaszów Mazowiecki (Poland), 5
31. Fijałkowski (1978), woj. Lubelskie (Poland), 5